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ABSTRACT

This report summarizes the methodology and response to a survey used to determine the need for university-level undergraduate computer science education in Central Oregon and how best to address this need. Fifty Central Oregon businesses completed a survey intended to verify the perceived community need for computing graduates. Findings indicated that 22 of the responding businesses intended to hire a total of 95 new employees in computer science during the next two to three years; respondents were most interested in hiring employees trained in network administration and computer systems management; most respondents supported continuing education for their current employees; and 23 businesses were interested in hiring individuals trained in hardware maintenance, a new associate degree program at Central Oregon Community College. The paper concludes that there is sufficient demand to justify development of broad and basic computer science programs. Five computer and information science programs under consideration are noted. These would be located at Eastern Oregon University, Oregon Institute of Technology, Oregon State University, Portland State University, and the University of Oregon. Appendices include the survey form, tabular and graphic analysis of responses, and additional comments offered by survey respondents.(DB)

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The Need for Undergraduate Computer Science Programs Graduates Within the Central Oregon High-Technology Business Community

Richard A. Markwood and Jonathon V. McKee

Executive Summary

Central Oregon University Center is preparing to offer a degree in computing in response to community demand. Several Oregon University System (OUS) institutions have expressed interest in offering such a program. The University Center surveyed 53 Central Oregon businesses to verify the perceived community need for computing graduates. Twenty-two of the 53 businesses intend to hire 95 new employees in the next two to three years.

This report summarizes the methodology of and responses to a survey used to determine the extent of the need for university-level undergraduate computer science education in Central Oregon and how to best address this need. The information gathered will be used to help determine which of the several OUS degree programs would be most responsive to the needs of Central Oregon. The following computer and information science programs are under consideration:

- Eastern Oregon University: BS/BA in Computer Science/Multimedia Studies,
- Oregon Institute of Technology: BS in Management Information Systems; & BS in Computer Systems Engineering.
- Oregon State University: BS in Computer Science, & MS in Software Engineering,
- Portland State University: BS in Computer Science, and
- University of Oregon: MS in Applied Information Management.

The Central Oregon University Center is a collaboration between the Oregon University System (OUS) and Central Oregon Community College (COCC). The University Center expands college and university opportunities for residents of Central Oregon by delivering bachelor and master's degree programs on campus at COCC. COCC provides campus facilities, classrooms, laboratories, staff assistance, etc., and the University Center delivers degree programs.

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The Need for Undergraduate Computer Science Programs Graduates Within the Central Oregon High-Technology Business Community

Central Oregon University Center is preparing to offer a degree in computing in response to community demand. Several Oregon University System (OUS) institutions have expressed interest in offering such a program. During the summer of 1998, the University Center conducted a survey of Central Oregon businesses to verify the perceived community need for computing graduates. The survey intended to provide information that would help the Oregon University System institutions understand the needs for computing education in community and would verify whether or not graduates of the program would be welcomed in the Central Oregon job market.

Research Questions

The survey attempted to answer two primary questions:

- Will Central Oregon organizations be hiring personnel trained in computing during the next two to three years?
- Which of the prospective computer science or information systems program is best suited to produce graduates needed by Central Oregon business community?

Programs under consideration include the following:

Eastern Oregon University: BS/BA in Computer Science/Multimedia Studies: The student in this program can select either a Bachelor of Science in Computer Science or a Bachelor of Arts in Multimedia Studies. The curriculum for the BS in Computer Science includes network administration, computer systems management, and programming.

Oregon Institute of Technology: BS in Management Information Systems, & BS in Computer Systems Engineering: The Bachelor of Science in Management Information Systems emphasizes network administration and programming. The Bachelor of Science in Computer Engineering emphasizes software design and programming.

Oregon State University: BS in Computer Science, & MS in Software Engineering: The Bachelor of Science in Computer Science and Masters of Science in Software Engineering emphasize software design and programming.

Portland State University: BS in Computer Science: The Bachelor of Science in Computer Science emphasizes software design and programming.

University of Oregon: MS in Applied Information Management: The AIM program is a hands-on program for managers of information systems.

Methods and Procedures

Questionnaire

Working collaboratively with OUS the Central Oregon University Center developed a simple six-question instrument to encourage response from busy businesspersons. The original questionnaire was pilot tested by seven members of the COCC faculty and administrative staff. The questionnaire was revised in response to constructive criticism of the pilot test participants. The designers wanted an instrument that could be completed in a relatively short amount of time, and planned for an 80 percent response.

Sample

The businesses and organizations selected for the study were taken from the population of "high technology" users and producers identified by by the Central Oregon Intergovernmental Council and Central Oregon Economic Development Council. The combined lists represented 98 Central Oregon businesses and organizations of this type. The list was subdivided into four categories:

- 60 manufacturing businesses and organizations (61 percent of the population),
- 10 banking and financial establishments (10 percent),
- 12 government agencies and not-for-profit organizations (for example, US Forest Service and Central Oregon Community College) (12 percent), and
- 16 service providers (for example, Internet Service Providers and Cellular Telephone Service Providers) (16 percent).

From this list 53 businesses and organizations were selected to participate in the survey. In each category the five largest firms were automatically included. Ten additional subjects were then randomly selected from each category (where possible). This resulted in using the entire populations in all but the manufacturing sub-group. The survey was mailed to the chief executive officer who either completed the survey or assigned it to a staff person. This sampling plan assured that the largest employers would be included and guarded against a survey sample of very small organizations.

The following steps were used:

- July 7th mailed a personalized advanced letter notifying them of their selection and the nature of the survey.
- July 14th mailed the questionnaire with a cover letter explaining the scope of the study.
- July 21st mailed a card thanking the respondents and prompting a response from non-respondents.
- August 6th mailed a second questionnaire to non-respondents.
- August 18th telephoned each non-respondent.

Response Rate

Fifty-three surveys were mailed; fifty responses were completed and returned (48 by mail and two by telephone interview). This represented a 94 percent response.

Limitations of the Study

1. For the most part the survey was mailed to either the chief executive officer or the chief information officer. However, we do not know who completed the survey; we assume that it was a knowledgeable management level person. The survey results are only as reliable as those persons' ability to project the organizations needs during the next three years.

2. In the first question of the survey, we attempted to characterize the prospective programs in seven short descriptors, e.g. "multi-media production," "systems analysis," "network administration." Our intent was to see whether there were apparent needs for one type program over another. We wanted to understand whether manufacturers' needs were different from bankers, and bankers' different from schools. However, since we did not define these terms it is difficult to know whether differences in responses truly indicated differences in needs. The differences between system analysis, network administration, and computer systems management may be very slight in certain settings in which one or two persons are operating an organizations computing infrastructure. At the same time, there is a significant overlap in the basic curricula in all of these programs.

3. Finally, our population was selected because we knew businesses who work in "high technology" areas are most likely to hire graduates trained in computing. However, we made no attempt to survey other businesses not on the "high technology" lists. We recognize, however, that virtually everyone in business today uses computers. Our selection process favors large "high technology" businesses, and ignores a host of other businesses either because they don't qualify as "high technology" or because they are small.

Summary of Findings

- Will Central Oregon organizations be hiring personnel trained in computing during the next two to three years?

The sample population replied that they intend to hire 95 employees in the next 24-36 months. This finding is amplified below in the discussion of Question 3.

- Which of the prospective computer science or information systems program is best suited to produce graduates needed by Central Oregon business community?

The top two responses were Network Administration (31), Computer Systems Management (30). There is a slight difference in preference between the manufacturers who favored Programming, and Systems Analysts and the other groups. However, the language of our questionnaire is not precise, and there are probably semantic differences between manufacturers and government agencies (for example). We prefer to interpret these differences with caution. There is a broad common curriculum in all of the programs under consideration, and that all of them could be responsive to the needs as expressed. As we continue discussions with the prospective programs we will look for a best fit that will include many considerations, one of which is the specific curriculum.

Overwhelmingly those businesses and organizations will consider hiring a University Center graduate to fill those future staffing needs. This represents an important opportunity for continuing higher education.

The majority of the respondents will support continuing education for their current employees. Therefore, there is probably a large higher educational need beyond the 95 employees that will be hired in the next 24 to 36 months.

Finally, Central Oregon Community College plans to begin granting an Associate of Applied Science in Computer Science in 1999, which will have an emphasis on Hardware Maintenance. COCC should be encouraged that 23 businesses and organizations indicated a need for trained workers in this area.

Item by Item Discussion of the Questionnaire

Question 1: "Which of the following program areas most clearly address you staffing needs?"

The majority of respondents selected either Network Administration (31) or Computer Systems Management (30) as their top choices for a program area to address current staffing needs (see Appendix IIa). Next in order of preference were Hardware Maintenance (23), Programming (15), Multi-Media Production (13), Systems Analysis (13), and Software Design (12). Only five businesses and organizations circled "other," which was the lowest response and may indicate that the list of program areas used for the survey was very complete.

The Manufacturing sub-group selected Programming and Systems Analyst more frequently than the aggregated groups (see Appendix II). However we are cautious about making too much of this difference because (1) we did not clearly define these terms nor test the validity of our terms and how they were interpreted, and (2) we suspect that the manufacturers have more sophisticated or complex computing operations which could lead to their being more specific in registering unmet needs.

Question 2: "Rank the following 1 - 4 (4=most likely) in order of your preference to hire."

Appendix III indicates that a baccalaureate degree may most likely meet the needs of Central Oregon businesses and organizations. The number of responses for Bachelor's Degree was 18. The next highest response was for Experience Only (12), followed closely by Associate's Degree (10). Finally Master's Degree received the lowest score (8).

Although this question begins to provide data regarding employer preference to hire, it is still far from conclusive. For instance, it might be possible to prefer to hire a master's degree for one type of computing expertise, and experience only for another.

Question 3: "Are you likely to hire staff with a Bachelor's or Master's degree in computing in the next 24-36 months?"

Forty-six businesses and organizations responded to question three. Twenty-four said they are likely to hire 95 employees in the next 24-36 months. Twenty-two said they are not likely to hire in the next 24-36 months. It is important to note that the manufacturing sub-group is anticipating hiring 54 of the 95 new employees.

Question 4: "If the program content addressed your needs would you consider hiring a graduate of a University Center program?"

Forty-eight businesses and organizations responded to this question, with 45 indicating that they would definitely or probably consider hiring a University Center graduate. The question was intended to detect prejudices against programs that are brokered into Central Oregon through the University Center. The preponderance of positive responses is reassuring. The three negative responses were evenly distributed across the sub-groups.

Question 5: "If a University Center program addressed your organizations needs, would you encourage your staff to participate?"

Forty-nine businesses and organizations responded to this question, with 46 indicating that they would definitely or probably encourage their staff to participate in a University Center program. Again, the three negative responses were evenly distributed across the sub-groups.

Question 6: "How many employees does your company currently employ?"

Our attempts to insure we surveyed the largest employers were successful. Half or more of Manufacturers, Financial, and Government subgroups were organizations of 51 or larger. By contrast half of the service sub-group are organizations of 1 to 10 persons.

Conclusion

We believe that there is a sufficient known demand for employees indicated by this survey to encourage continuing the dialogue with the prospective OUS computer science degree programs. The curriculum content should be broad and basic. We believe that the broad and basic content could be found in any of the degree programs under consideration and that the choice of which program will become clearer as we meet with the various program and institutional staffs. As we engage in this discussion with the program staffs we will invite the participation of one or two of the companies in order to provide a real world perspective in our discussion.

Appendix I

Higher Education Needs Assessment
A Survey of Central Oregon Business and Organizations

Circle the letters of your choices. Use the reverse side to comment on any item; use the item number to identify your comments.

1. Which of the following program areas most clearly address your staffing needs? (Circle all that apply.)
- multi-media production
- software design
- hardware maintenance
- systems analysis
- programming
- network administration
- computer systems management
- other (please comment on the back of this sheet)

2. Are you more likely to select an employee with?
- experience only
- 2 year degree
- 4 year degree
- master's degree

3. Are you likely to hire staff with a Bachelor's or Master's degree in computing in the next 24 to 36 months?
- definitely yes (how many_____)
- probably (how many_____)
- more than likely not

4. If the program addressed your needs would you consider hiring a graduate of a University Center program?
- definitely yes
- probably
- more than likely not

5. If a University Center program addressed your organization's needs, would you encourage your staff to participate?
- definitely yes
- probably
- more than likely not

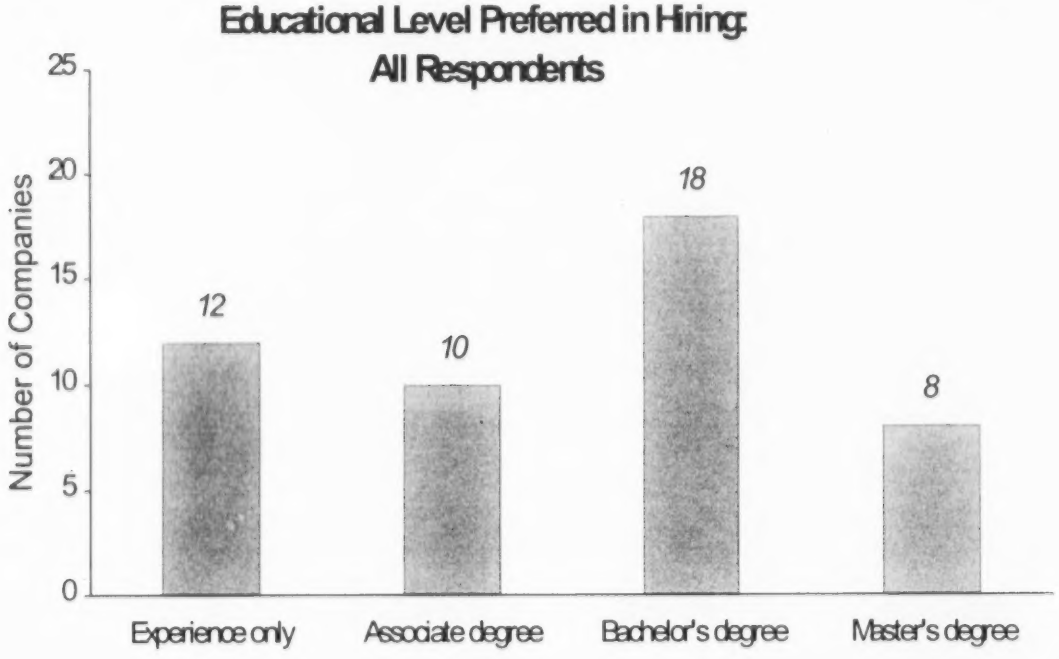
6. How many employees does your company currently employ?
- 1 TO 5
- 6 TO 10
- 11 TO 25
- 26 TO 50
- 51 and over

Appendix II: Program Areas of Staffing Need Identified by Survey Respondents

Program Area	Manufacturing (N = 10)	Financial (N = 11)	Government (N = 12)	Service (N = 15)	All Respondents (N = 48)
Network administration	5	8	9	9	31
Computer systems management	5	7	9	9	30
Hardware maintenance	6	2	9	6	23
Programming	8	1	1	5	15
Multi-media production	4	2	5	2	13
Systems analysis	0	1	6	6	13
Software design	7	1	1	3	12
Other	1	1	0	3	5
Total	36	23	40	43	142

Appendix III: Educational Level Preferred in Hiring:
Distribution of Responses Indicating "Most Likely to Hire"

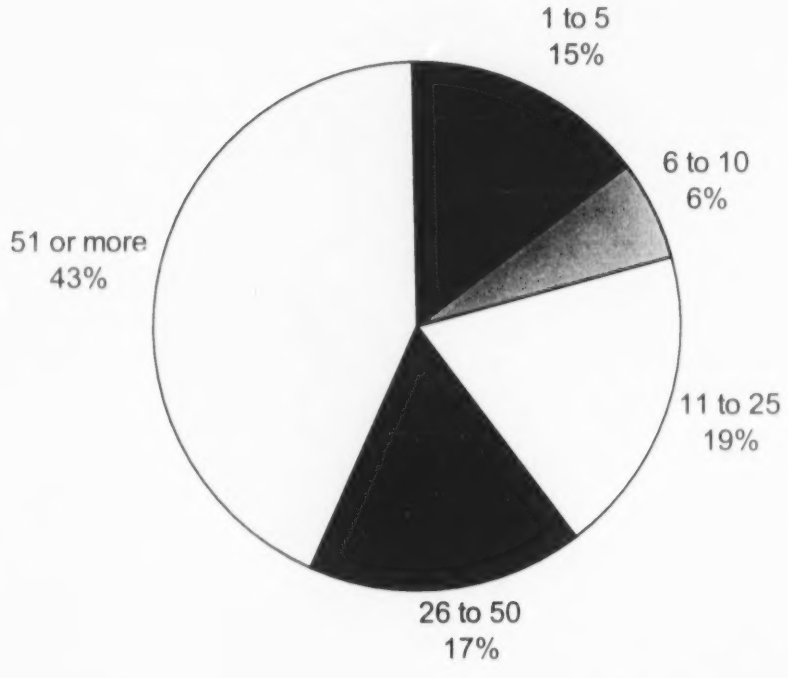
Educational Level	Manufacturing	Financial	Government	Service	All Respondents
Experience only	3	3	2	4	12
Associate degree	1	3	3	3	10
Bachelor's degree	4	4	5	5	18
Master's degree	2	1	2	3	8
Total	10	11	12	15	48



Appendix IV: Distribution of Responding Companies by Number of Employees

umber of mployees	Manufacturing	Financial	Government	Service	All Respondents
to 5	0	2	0	5	7
ıo 10	1	1	0	1	3
1 to 25	1	1	2	5	9
6 to 50	2	2	1	3	8
1 or more	6	5	9	1	21
Total	10	11	12	15	48

Responding Companies by Number of Employees
(Total companies = 48)



Appendix V - Respondents Comments

The following is a verbatim listing of all respondent comments.

Question 1

H. Additional Comments

- Computer security
- Firewalls
- Web site production
- Windows NT
- Network design
- MCSE/CCNP/Solaris certifications
- Web design and publishing
- Interactive courseware development

I believe that well-rounded education experience in all aspects of software engineering is of the most value to the smaller companies of Central Oregon. Software people wear many hats in the smaller companies and having education and experience in a variety of software specialties (jack of all trades/expert in none) is of extreme value. In larger companies (Boeing, Microsoft...) a software engineer is much more likely to focus on a single are of expertise. Master's degree programs are nice, but for our company, an individual with a lesser degree and a broad experience base would be most likely to be more valuable.

Question 2

In reverse order, we certainly couldn't afford to pay for someone with a masters and experience

Based on my work with other computer-related business in the area, a degree and real-world experience are valued.

Our organization bias for a BA or BS in Liberal Arts is clear, selected Masters programs are also desirable. Even though the programs/courses of study that you suggest would be of value to us, I believe you are in a unique position to serve a larger market with a wide range of degree programs.

Part of any program and the success of it is how integrated in the "Real World" the program is - be careful to ensure that you get local businesses to interact with the program, or you get the kids/part of the curriculum to include field/business experience.

Not a good question - requirements vary greatly by position.

Most local (Central Oregon) employment needs at U.S. Bank are entry-level positions. However, computer technical skills are highly regarded in metropolitan areas.
We recently hired a director of Information Systems, so currently our staffing needs are being met. There might be a need in the future depending on company growth.

This ranking will depend on need, but generally the goal is to minimize overall cost to the company.

In applications programming and systems administration, two years of practical experience are worth far more than 4 years of formal education. In hiring, I don't care how they come to know what they know, just that they know it... and have used it in the real world. Any courses you design have to include a strong hands-on experience on realistic projects. Purely academic knowledge is purely useless.

Four-year degrees don't seem to matter in today's workplace. The exception to this rule is where the coursework includes on the job, job share, or apprentice time. The coursework in University courses is always years out of date and not applicable to what is happening in most companies. I'm not certain that the University courses are keeping up with the technological changes we are seeing today. Whatever is taught, the practical and hands-on training is essential for any program to be worthwhile.

Question 3

We're a two-person office and probably won't hire anybody in the foreseeable future.

Question 6

Only one computer person in-house. We outsource hardware problems. Will hopefully hire two more this year, one in the PC support specialist level.

I am a single person business. However, I need to contract with other professionals from time to time.

Technology support staff only 11-25.

The Bend-LaPine School District currently employs about ten individuals that work in the computer and network support area. We anticipate that many of the teaching professionals in the district will require computer systems training as the profession becomes more and more technology oriented. There are currently about 625 teachers' employed by the school district.

General Comments

Sorry for the delay in my response

I have responded based solely on my own development companies needs. PLEASE NOTE Airport Business Center is a 60-Acre office/industrial park near the airport and COCC North/OIC in Redmond, and at present the project is just taking shape (5 of 35 lots sold, phase I infrastructure is only in). So, there's going to be mega needs, I believe, over time, as businesses come in. Thanks for the opportunity.

I support the University Center concept but the focus of your survey seems to be computer technology. Our need includes technology but also other technical areas such as civil engineering, planning, etc. Would like to see programs in these are of urban development.

A local program for preparation would be valuable.

As a telecommunications business in Central Oregon, the labor pool for computer literate personnel is pathetic. With the anticipated growth in the professional fields (especially hi-tech) it is imperative that Central Oregon provide a 4-year degree and educational institution to continue to attract both people and business to this community and also provide future labor for these growth industries.

I am pleased that the University Center is making moves in this direction. The more talented the pool of available workforce is, the more businesses look to this are to relocate. This is only good for our business.

We need help Transitioning our workforce to be competent and capable in a world that relies on computers. Most of us have limited experience and competence in computers.

I completed this survey basing my answers on the company, not just the local branch.

Greatly needed.

I would hope the expansion of 4-year degrees through COCC will continue... perhaps offering teaching degrees in the future as well.

As a branch office, the only thing we do is a use computer. Answers to questions such as these would need to be answered by our computer division in Seattle.

I would also encourage you to tap available talent in Central Oregon to assist in curriculum development, instruction, research, etc. For example, I have a Ph.D. degree in Engineering/solid state physics and retired to Central Oregon in 1997. I worked for Microsoft and am a computer professional. When I took my resume to COCC to see if I could assist in some way - even for zero pay - I was told a) they can't take résumé's by law, and b) I could fill in a (only one) postcard and when the next position came up they would send me the postcard announcing the job. I got the postcard in a few weeks announcing an opening the ground maintenance crew! What a shame.

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